

porated in the work before us. In this first volume of his work the discharge of water is very fully treated. Unfortunately, however, his so-called theoretical formulas belong to the same category as those which Prof. James Thomson of Glasgow showed in his paper, read before the last meeting of the British Association, to be founded on assumptions which are not in accordance with known hydrodynamic principles.

On page 851 of this translation there is a formula to which we would draw attention. It is taken from "The Lowell Hydraulic Experiments," by J. B. Francis, and is for the discharge of water over a weir. This formula is " $Q = 3.33 (l - 0.1 nh)h^{\frac{3}{2}}$ English cubic feet, in which h denotes the head of water above the sill of the weir, l its length, and n either 0 or 1 or 2, according as the contraction of the vein is prevented upon both, one, or none of the sides." Prof. Thomson, in the above-mentioned paper, referred to this formula as identical, in its general form $a(l - \beta nh)h^{\frac{3}{2}}$, with the one which he had deduced from known principles as the true theoretical formula. Mr. Francis put it forward merely as an empirical formula which agreed with the results of his experiments, and it is curious that he should have made a guess which turned out to be more in accordance with the true theory, than all the previous so-called theoretical formulas, which had been advanced and sanctioned by the best authorities.

PATRICK EDWARD DOVE

OUR BOOK SHELF

A General Dictionary of Geography, Descriptive, Physical, Statistical, Historical; forming a Complete Gazetteer of the World. By A. Keith Johnston, F.R.S.E. New edition, thoroughly revised. (London: Longmans and Co., 1877.)

THE title of this work is somewhat misleading. The "physical" and "historical" elements are so meagre that they are scarcely worth mentioning as features of the work. To call this a "complete gazetteer of the world" is a misuse of the term "complete;" *incomplete* would have been more accurate. Even on the scale of the present work it would take a gazetteer at least three times its size to contain anything like a register of all the places one would naturally expect to find in a "complete" gazetteer. The work includes a selection of the more important places in the world, very few towns, for example, out of the United Kingdom being given, whose population is under 1,000. We find no fault with the publication of a selective gazetteer, but it should not pretend to be more than it is. When compared with Ritter's well-known work, *e.g.*, the proportion of places found in the latter as compared with "Johnston" is something like five to one. We believe a service would be done to the public by the issue of a gazetteer containing simply all the names omitted in "Johnston." It is not for well-known places we turn up a gazetteer, but for names that one seldom hears. During these Eastern troubles, how many names of places not to be found in "Johnston" have become of great importance, and during the war just begun how many more are likely to come prominently into notice? On the other hand, much valuable space is occupied with catalogues of streets and public buildings in the articles devoted to well-known places like London, Edinburgh, Paris, Vienna, &c. All that can be said about public buildings and similar features of a town in a gazetteer of this scale is practically useless; the space would be used to much better purpose by an enlargement of the list of names. In Russia, for example, nearly all "towns" and "villages" seem to be omitted.

many of them with thousands of inhabitants, only "district towns," as a rule, being given. Poland and Finland are also very unsatisfactory; in fact these countries have never been properly "gazetteered" even in Russia. In several instances the "latest" information has evidently not been obtained. To get it, indeed, would involve a vast amount of research among official publications and travellers' narratives, but in a standard work such research is demanded. In Switzerland, we are informed by a Swiss friend, much of the information is half a century behind date. Under Chaux-de-Fonds, *e.g.*, the statement with regard to the manufacture of chains for the movements of watches has not been true for at least thirty years; and there is no lace now made at St. Imier. To arrange the wealth of information published by the United States Survey alone would involve much time and labour; we fear that for the new edition this has not been thoroughly done. Nearly two years ago Mr. W. H. Dall, of the United States Coast Survey, published a Report on the mountains in the Alaska territory. Yet no use has been made of this Report though it is quite accessible. For Mount St. Elias the height in the English Admiralty Chart, 14,970 feet is given, instead of upwards of 19,000 feet, obtained by the careful measurement of the United States Survey in 1874. The height of Mount Fairweather is set down as 14,708 (1855) instead of 15,500 (1874); Mount Crillon 13,500 instead of 15,000; Mount Cook 16,000, Mount La Perouse 11,300, and Mount Vancouver 13,100 feet, are not given. Such imperfections make one doubt if this new edition has been "thoroughly revised." It is easy to give information contained in census tables and in other gazetteers and guide-books, but even a work on the limited scale of the present cannot be made throughout trustworthy without very considerable trouble being taken.

Zoological Classification. By F. C. Pascoe, F.L.S. (John Van Voorst, 1877.)

THIS small work will be found particularly serviceable to many working naturalists. It is a concise compilation of the sub-kingdoms, classes, and orders of the animal kingdom, with lists of the families and most important genera. Specialists will be able to find fault with some of the details in many cases, nevertheless we know no volume which, in the space, contains so much reliable information. The larger groups are all succinctly defined, with many of the most modern views incorporated; and these definitions extend to the orders. Taking the mammalia for criticism, we regret to find the Sirenia included with the Cetacea, the Musk Deer with the Chevrotains, the Peccaries with the true Swine, and the Camels between the Giraffe and the other typical ruminating animals. The caccum is not "enormous" in Hyrax. "Whatever gaps there may be at the present day" between the Perrissodactyla and Artiodactyla "are not nearly all filled in by numerous extinct forms." Such errors may be found in many places; they do not, however, much detract from the general value of the work, which will be found more valuable as a basis for annotation, than a book of reference. There is a very complete index we are glad to say.

Tracts relating to the Modern Higher Mathematics. Tract No. 2, *Trilinear Coordinates.* By Rev. W. Wright, Ph.D. 77 pp. (London: Messrs. C. F. Hodgson and Son, 1877.)

DR. WRIGHT is, or was until quite recently, Professor of Mathematics at Wilson College, Pennsylvania. His object is to make his countrymen acquainted with certain branches of modern mathematics, and we learn that his first venture (Tract No. 1, *Determinants*) has met with considerable acceptance in the American universities. M. Hermite, too, has expressed himself well pleased with the author's standpoint, "Une grande transformation s'est déjà faite et continue encore de se faire dans le domaine de l'analyse; des voies nouvelles plus fécondes, et

je crois aussi plus faciles, ont été ouvertes, et c'est l'œuvre de ceux qui veulent servir la science et leur pays de discerner ce que les éléments peuvent recevoir de l'immense élaboration qui s'est accomplie depuis Gauss jusqu'à Riemann."

There is in the present tract a clear exposition of the elementary applications of Trilinear and Triangular Coordinates, and just a passing glance at Polar reciprocals.

In such a work we do not look for anything original, but for clearness and correctness. These ends, we think, have been attained, and we wish Dr. Wright health and leisure to enable him to carry out his design.

Grundriss der chemischen Technologie. Von Dr. Jul. Post. (Berlin: Robert Oppenheim, 1877.)

DR. POST, who is known to chemists as an able Privat Docent at the University of Göttingen, has, like many other teachers, felt the great necessity of a manual of chemical technology, suited to the requirements of students who desire a general training in that branch of applied chemistry. A considerable number of excellent treatises, as, for example, those of Knapp, Wagner, Bolley, Kerl, and Stohmann, already exist in German, and some of them have been translated into English, but no one of them is exactly adapted to the class-room. Their excellence consists in their completeness as works of reference; indeed as such they may be said to be invaluable to the chemical manufacturer; but the mode of their arrangement renders them of comparatively little value as aids to systematic study. Dr. Post has succeeded in producing a work which, within the compass of some of our smaller chemical manuals presents a complete outline of the present position of chemical technology. His book thus serves as a fitting introduction to the larger and more special treatises above mentioned.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Colour-Sense in Birds

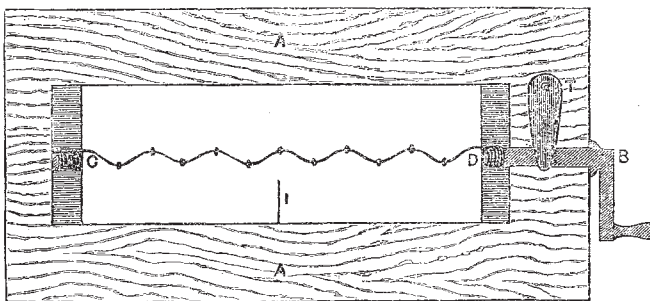
I HAVE been lately watching, with great delight, two goldfinches building their nest. They placed it nearly at the end of an outside branch of a young sycamore tree, so that there was nothing but sky above it, and the gravel path below. The window from which I observed them, being never opened, and well covered with flowers in pots and a blind, seems to have caused them no alarm, although not more than two yards distant from them; and their object appears to have been to make their nest invisible from below. To this end they chose their building materials with such skill and such colour-matching power that if one had not seen the nest built it would be quite impossible to discover it; to match the tree they took its long flexible blossoms, and to match the sky the equally long and flexible stalks and flowers of the garden forget-me-not, of which a bed was close at hand in full bloom. I watched them carefully, and, as far as I could see, they used no other materials than these flowers, though I saw one of them attempting to get the dirty-white cotton tie off a budded rose-tree. At all events the nest was mainly built of them. The blue of the forget-me-not has of course faded, but the general effect from below is that of a scarcely visible grey-green thickening of one of the bunches of sycamore leaves. They seemed to enjoy flinging their flower-wreaths about. And that leads to the question whether birds—who are in many ways like children—do not often out of mere playfulness and love of colour, pull to pieces yellow crocuses and other bright flowers. While my pen is in my hand I may mention, with reference to Dr. Muirhead's communication on the subject of noise causing a sensation of colour, that I have frequently observed whilst tuning a harp,

that the sudden breaking of a string will cause a curious taste and sensation in the mouth, like that produced by a piece of silver and one of zinc placed above and beneath the tongue, when they are made to meet.

A Simple Wave-Motion Apparatus

It has been suggested to me that I should publish a description of a simple and portable wave-motion apparatus, devised by me a year or two ago, which has given satisfactory results to others as well as to myself. I therefore send the description.

In the figure A A represents an ordinary wooden lantern slide, with a rectangular aperture, which may vary in size according to the size of the lantern condensers, the sketch being half size for 4-inch condensers. A small winch, B, is fitted into the slide at one end of the aperture, and held in its place by the tongue, T. The spindle, B D, is milled or otherwise roughened near the end, D. A brass stud similar in shape to the milled end of the spindle, but smooth and slightly smaller, is fixed in the opposite side of the aperture at C. A helix of 25-gauge hard brass wire is wound on a spit of the same size as the smooth stud, taking care to wind the coils close together; about fifteen turns of the helix are cut off, and the middle five turns drawn out till they form a perfect wave similar to the figure when held up to the light. The length of the helix should then be the same as C D. One end of the helix is pushed tight on the milled end, D, and the other end is slipped loosely over the stud, C, so as to work



on it like a swivel, to keep the end of the helix true when the winch is turned. A little bead of wax is melted on each crest and hollow of the wave to represent particles, and the essential parts of the apparatus are complete. On placing it in front of the lantern, and focussing, a distinct and striking image of a moving wave with its vibrating particles is produced by turning the winch.

If the helix is not perfectly straight the image of the wave will rise up and down more or less as a whole; the helix should then be straightened or "set" with the fingers till true. When once set thin glass plates may be placed on each side to protect it from injury. An index, I, of wire, may be fixed so as to give a means of proving that the particles only move up and down.

A modification I have tried, by using a dark wire with bright silver beads, on a velvet back-ground in the aphic gescopie, is more difficult to make and use. I therefore prefer the apparatus as sketched above.

Of course the amount of finish depends on the taste of the user, &c. A pasteboard frame instead of mahogany, a wire bent twice at right angles instead of a finished brass winch, and tied to the frame by two bits of wire instead of let in, &c., may be used, thus reducing the cost to a few halfpence.

In use it will recommend itself.

W. JESSE LOVETT

Birmingham

Atmospheric Currents

A CONTROVERSY was recently waged in your columns as to the course which is pursued by the hot water-laden air of the equatorial regions in its journey to the poles. Both combatants seem to adopt what I may call the sheet-theory, which regards the winds as moving in sheets or strata, and gliding over and under each other at the polar and equatorial sides of the calms of Cancer and Capricorn, a process which would inevitably result either in both opposing winds being torn to tatters, or in their commixture and neutralisation. Surely the truth is that like all other moving fluids, the air will seek equilibrium in the direction of least resistance, and will carve out for itself wide channels in accordance with local conditions from the poles to the equator,